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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/SE88/00650 <b>(22) International Filing Date:</b> 25 November 1988 (25.11.88)  <b>(31) Priority Application Number:</b> 8704891-4 <b>(32) Priority Date:</b> 7 December 1987 (07.12.87) <b>(33) Priority Country:</b> SE  <b>(71) Applicant:</b> CASCO NOBEL AB [SE/SE]; Box 11550, S-100 61 Stockholm (SE). <b>(72) Inventor:</b> LEHNERT, Emil ; Sandhamnsgatan 25I, S-115 28 Stockholm (SE). <b>(74) Agent:</b> SCHÖLD, Zaid; Nobel Industries Sweden AB, Patent Department, Box 11554, S-100 61 Stockholm (SE).		<b>(81) Designated States:</b> AT (European patent), BE (European patent), CH (European patent), DE (European patent), FI, FR (European patent), GB (European patent), IT (European patent), LU (European patent), NL (European patent), SE (European patent).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> A METHOD FOR THE PRODUCTION OF WOOD PRODUCTS  <b>(57) Abstract</b>  <p>The present invention relates to a process for the production of wood products such as plywood and similar products. In the process a formaldehyde based curable adhesive is applied to a surface of a veneer layer and a separate hardener is applied to a surface of another veneer layer opposite to the one coated with adhesive. The separate hardener is applied in a zone along at least two edges of the surface which are opposite to each other. A number of veneers are coated in this manner and the veneers are then assembled to a package which is cold pre-pressed. The package is then cured by pressure and heat.</p>		

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A method for the production of wood products

The present invention relates to a method for the production of wood products such as plywood or similar products. More particularly the invention relates to an improved cold pressing technique at pre-pressing a package of veneer.

In the production of plywood, glue is applied to veneers and a number of glue coated veneers are assembled to a package. This package is usually cold pressed before being hot pressed for the final curing. The number of veneers in the assembly is determined by the final thickness of the product. Suitably at least some of the veneers are placed with their grain directions perpendicular to the grain direction of the neighbour veneers. After glue application the veneers remain in the package for a longer or shorter time before this is further treated. The veneers hereby absorb moisture from the adhesive, they swell and become still more uneven than they were from the beginning. The veneer package becomes larger than the available press table opening of the hot press. To decrease the thickness of the package this must be pre-pressed cold. The pre-pressing shall also result in a holding together of the veneer layers at the further handling of the package. Here it is important that the cold tack of the adhesive composition (ie the bonding strength of the adhesive before this has been cured by heat) is sufficient for keeping the veneers together after the pre-pressing.

The adhesives used in the manufacture of plywood are usually phenol resins (condensation products of phenol and formaldehyde) and amino resins (condensation products of formaldehyde and urea and/or melamine). The amino resins do, however, give a high release of formaldehyde, both at pressing and from the finished products. If the molar ratio between formaldehyde (F) and comonomer (eg urea (U)) in the adhesive is lowered, the formaldehyde emission will, however, be decreased. To fulfil the demands with regard to environment it has been necessary to reduce the molar ratio considerably. At low molar ratios ( $F:U < 1.8$ ) the adhesive

has an inferior cold tack and long cold press times are then required to obtain acceptable results. For reasons of economy it is thus desired to have short assembly times and cold press times.

5        It is common to try to improve the cold tack of the adhesive by different additives. Among others, starch and gluten are used. In DE A 3125823 it is suggested to add acrylate resin dispersions with free carboxylic groups to increase the cold tack of amino resins.

10        The cold press properties of the adhesive are dependent on several factors, among others on the moisture content of the veneers and the type of wood in these. Even such factors as the adhesive formulation, the amount of adhesive and external climatic variations in the form of  
15        moisture and temperature changes are of importance. An adhesive formulation which works well in an industry in one place can be quite unsatisfactory in another location. Compensating for all these variations by different additives and modifications of the adhesive is not a good  
20        solution in practice. It is both toilsome and costly.

      The present invention, as disclosed in the patent claims, is directed to an improved method at cold pressing of packages of veneers. In the method one surface of a veneer layer is coated with a curable adhesive in a known  
25        manner. The veneer layer to be placed against the thus adhesive-coated veneer is coated with a separate hardener in a zone along at least two of its edges. If only two edges are coated, those opposite each other are chosen. The veneer package is then assembled with every second surface  
30        coated with adhesive and every second coated with a separate hardener. The package obtained in this manner is then loaded in the cold press and the adhesive is hereby cured in the zones along the edges which have been coated with a separate hardener when this is mixed with the adhesive. In  
35        the cold pressed veneer package the veneer layers will be kept together by means of the cured adhesive along the edges. The requirement for sufficient cold tack of the adhesive has thus been eliminated. The time for the cold

pressing can be kept short, since the separate hardener makes the adhesive cure rapidly. Hereby the need for long cold press times has also been eliminated. The cured adhesive along the edges gives as a result that also those veneers which before the cold pressing have undulating dented edges, due to moisture absorption, after the cold pressing will have straight edges which keep together well. The cold pressed veneer package is easy to handle and it is easy to introduce it into the often narrow space between the press platens in the hot press, where the final curing then takes place.

It is easily understood that it in order to make the veneer layers keep together in a package it can be fully sufficient to coat these along only two edges which are opposite to each other. If a greater safety and a stronger holding together is desired, the veneers can be coated along all four edges. The coating of different veneer layers with either adhesive or separate hardener can be carried out in arbitrary order. For a veneer package with three plies the middle veneer can thus, for example, be coated on both its surfaces with a hardener solution along the edges and the cover veneers can be coated with adhesive on one surface. Just as well the center veneer can be coated with adhesive on both surfaces and the cover veneers be coated with hardener on one surface, along the edges.

The separate hardener can be applied in a zone along the edges of the veneer layer. A suitable size for this zone can be determined by the man skilled in the art by simple tests. For large veneers a suitable width can be from 10 to 100 mm, preferably from 30 to 60 mm. The zone to which the separate hardener has been applied does not have to be entirely coated. It can be sufficient that the zone is coated in strings or in dots along its surface, among other things dependent on the application equipment. 10 mm broad strings can thus for example be applied respectively 15 mm, 25 mm and 50 mm from the edge.

The method according to the invention can be used with conventional formaldehyde based, curable adhesives

which are used in plywood production. Among these can be mentioned condensation products of formaldehyde and urea, melamine, phenol, resorcinol or mixtures thereof. It is preferred to use the method with urea-formaldehyde resins with a low F:U value, ie  $< 1.6$ . The applied adhesive contains, as conventional, a slow-reacting hardener for the final curing in the hot press. The applied amount of adhesive can vary within wide limits. As a suitable amount can, for example, be mentioned from 100 to 300 g/m<sup>2</sup>.

As separate hardeners conventional rapidly reacting hardeners are used. With a rapid reacting hardener is meant a hardener which gives the adhesive such a gelling time that it cures during the cold press process. The hardener should give the adhesive a gelling time of less than 1 hour, preferably of from 5 to 20 minutes. It is not possible to use such a hardener as the sole hardener for the adhesive, since the adhesive would then get a much too short assembly time, which would result in a curing of the adhesive before the veneer package has reached the hot press. Using the present process the adhesive cures only along the edges at the cold pressing. When the adhesive is an amino resin the hardener can for example be an inorganic or organic acid, such as phosphoric acid, trichloroacetic acid, citric acid or maleic acid. Acid salts, such as for example aluminium sulphate and aluminium chloride, can also be used. When the adhesive is a phenol resin the edges of the veneer layers can be coated with a basic compound, eg sodium carbonate.

The amount of applied separate hardener can also vary within wide limits. A suitable amount can be from 15 to 40 g/m<sup>2</sup> of a 20% aqueous hardener solution. To make certain of or to improve the adhesive technical properties the hardener can be combined with for example tack giving substances such as aqueous solutions or aqueous dispersions of polyvinyl alcohol, polyvinyl acetate, polyacrylates.

The press times required at cold pressing are of the same magnitude as for adhesives with good cold tack properties, and thus in the range of from 5 to 20 minutes,

preferably from 10 to 15 minutes.

The invention is further illustrated in the following examples wherein parts and per cent relate to parts by weight and per cent by weight, unless otherwise stated.

5 Example 1:

At the production of plywood 3 Abachi veneers with the dimensions 300x300x2 mm were used. The moisture content of these was about 10%. The center ply was coated with a hardener solution consisting of an aqueous solution of  
 10 citric acid and aluminium sulphate (20%) in an amount of 40 g/m<sup>2</sup> around the edges in a zone with a width of 10 mm. The hardener solution was coloured to give a better control of its spreading. The water was allowed to evaporate (this is, however, not strictly necessary). The other two veneers  
 15 were coated with a urea-formaldehyde adhesive to which an hardener had been added. The adhesive had a F:U ratio of 1.16 (as adhesive was used urea resin 1203 from Casco Nobel, 100 parts by weight with 20 parts by weight of hardener, hardener 2545 from Casco Nobel, based on ammonium  
 20 chloride). The amount of adhesive was 180 g/m<sup>2</sup> for a single adhesive joint.

Two tests were made with variation of the assembly time (ie the time before cold pressing) and the time between cold pressing and hot pressing. Each test was made  
 25 with separate hardener (test a) and without separate hardener (test b).

	Assembly time	Time between cold and hot pressing	Result
30 Test 1a	2 min	20 min	closed edges
Test 1b	2 min	20 min	open edges
Test 2a	20 min	5 min	closed edges
35 Test 2b	20 min	5 min	open edges

Cold pressing

Temperature: 23°C

Press pressure: 0.8 MPas

Press time: 10 minutes

5 Hot pressing

Temperature: 125°C

Press pressure: 1 MPas

Press time: 2.5 minutes

10 Example 2:

Example 1 was repeated but with 3 veneers of poplar having the dimensions 300x300x2 mm. The moisture content of these was about 5%.

15		Assembly time	Time between cold and hot pressing	Result
	Test 3a	2 min	20 min	closed edges
	Test 3b	2 min	20 min	open edges
20	Test 4a	20 min	5 min	closed edges
	Test 4b	20 min	5 min	open edges

25 Both the cold gluing and hot gluing results were excellent for the plywood panels prepared according to the present method. The cold pressed veneer package had a good stability, despite the short press time. At the tests without addition of separate hardener the veneer layers did

30 not keep together after the cold pressing.

Claims

1. A method for the production of wood products such as plywood or similar products by applying a formaldehyde based curable adhesive on veneer layers, assembling of the veneer layers to a package and cold pre-pressing of this, whereafter the package is cured by pressure and heat, characterized in that one surface of a veneer layer is coated with the curable adhesive and a surface opposite to this is coated with a separate hardener in a zone along at least two edges opposite to each other.
2. A method according to claim 1, characterized in that one surface of a veneer layer is coated with a separate hardener in a zone along two edges opposite to each other.
3. A method according to claim 1, characterized in that the zone is coated in dots or strings along its surface.
4. A method according to claim 1, characterized in that the separate hardener is a rapid-curing hardener.
5. A method according to claim 4, characterized in that the hardener is combined with a tackifying substance.
6. A method according to claim 5, characterized in that aqueous solutions or aqueous dispersions of polyvinyl alcohol, polyvinyl acetate or polyacrylates are used as tackifying substances.
7. A method according to claim 1, characterized in that the adhesive is a urea-formaldehyde adhesive with a molar ratio formaldehyde:urea  $< 1.6$ .

# INTERNATIONAL SEARCH REPORT

International Application No PCT/SE88/00650

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC <sub>4</sub>		
B 27 D 1/04, C 09 J 5/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC 4	B 27 D 1/00, 1/04, 3/00; B 27 G 11/00; C 09 J 5/00, 5/06	
US C1	156:258, 373, 544-546; 144:281, 313-319, 332, 344-355	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
SE, NO, DK, FI classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	SE, A, 370 546 (AB CASCO) 21 October 1974 See whole document.	1-7
A	SE, A, 375 317 (AB CASCO) 14 April 1975 See whole document.	1-7
Y	DE, A1, 3 518 947 (ROBERT BOSCH GMBH) 27 November 1986 See whole document.	1-7
Y	SE, A, 368 219 (S.A. ROQUETTE FRERES G DES FECULER- IES & AMIDONNERIES DU NORD) 24 June 1974 See whole document. & SE, 368219 FR, 1561222 DE, 1816698 GB, 1255619	1-7
Y	SE, A, 331 186 (AB CASCO) 14 December 1970 See whole document.	1-7
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>10</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
1989-02-20		1989-02-24
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